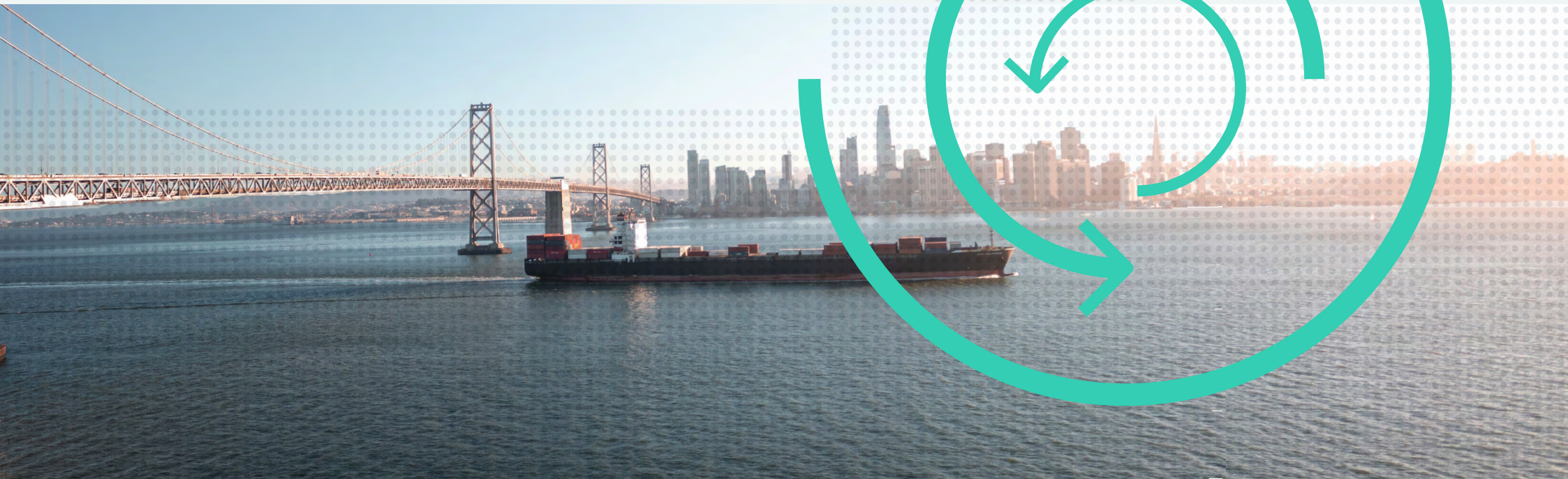
The Circular Shipping Initiative

How the Circular Economy could introduce new value to the shipping industry



Executive Summary

The shipping industry has been burdened by surplus capacity, low freight rates and depreciating secondhand prices for much of the past decade. New technologies are being applied to existing business models to lower costs and enhance efficiency. But it becomes increasingly hard for individual players to develop a competitive edge if operational excellence is delivered th-rough third-party algorithms or software available to all industry players. In many cases, these new technologies are simply redefining shipowners' licence to operate.

The problem

The traditional guiding principles of value creation in the shipping industry are being corroded by the introduction of new technologies and more interconne-cted global supply chains. The industry is struggling to navigate the short-term agenda of trade and geopolitical tensions and the enforcement of new environmen-tal regulations. Few players are conside-ring the potential in adjacent markets, different parts of the value chain, and n ew industries.

Why it matters

The digital transformation of the shipping industry and the deeper integration into global supply chains will test core bu-siness models. Some players will focus on the ecosystem play related to the movements of cargo, and others will work to standardise and scale business models of vessel ownership, while the more traditional players will continue their current operations. Shipowners that do adapt to the emerging changes and begin to digitalise and innovate their business models may begin to yield a higher return on invested capital.

What to think about

We need to think critically about potential new sources of value, shifting competitive dynamics, and regulatory policies that affect both the revenue and expense sides of the business. We believe that the adaptation of circular principles is become a critical element in the field of business model innovation.

> "Some players will focus on the ecosystem play related to the movement of cargo...

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Introduction: The global transition towards a circular economy

The climate agenda and the transition towards a global circular economy represents a great business opportunity for the shipping industry.

Short-term tensions over trade, geopolitics and new environmental regulations are capturing the attention of the shipping industry, masking a more structural shift that is taking place in the shadows. The introduction of new technologies and the transition towards a global circular economy are about to fundamentally change how value is created in the shipping industry.

Climate change has become a defining issue of our time. Winter temperatures in the Arctic have risen by 3°C since 1990, sea levels are rising, coral reefs are dying, and we are starting to see the life-threatening impact of climate change on health, through air pollution, heatwaves and risks to food security.

These impacts are being felt globally, across regions and across industries. We are seeing a global push to boost ambition and accelerate actions to implement the Paris Agreement on Climate Change. The growing recognition that affordable, scalable solutions are now available is creating global momentum in business model innovation towards a more circular global economy.

A shift towards a global circular economy requires a fundamental transformation of economies and the industries underlying them. We need to intensify the recycling of materials and the introduction of new technologies to help us discover and design new materials for the circular economy.

Some global corporate players are forerunning the agenda and have formulated ambitious targets not only to reduce emissions but to become climate positive in the not-too-distant future.

The financial sector is also adapting. We are beginning to see a growing number of players that are gradually requiring more than just returns on their investments; they are demanding distinct environmental, social and governance (ESG) profiles from the companies they finance or invest in.

The logistics industry has not been at the forefront of these developments but is beginning to respond to the strong signals from politicians, investors, banks, cargo owners and customers. It has become clear that we need new approaches and solutions to put us on an accelerated path to sustainable business models.

Shipowners of tomorrow will not exclusively be transporting goods from A to B. They will be working to facilitate the global transition towards a circular economy.

The Circular Shipping Initiative

The Circular Shipping Initiative, a project funded by the Danish Maritime Fund, has set out to explore the business opportunities for shipping in the global economy's transition to a circular society.

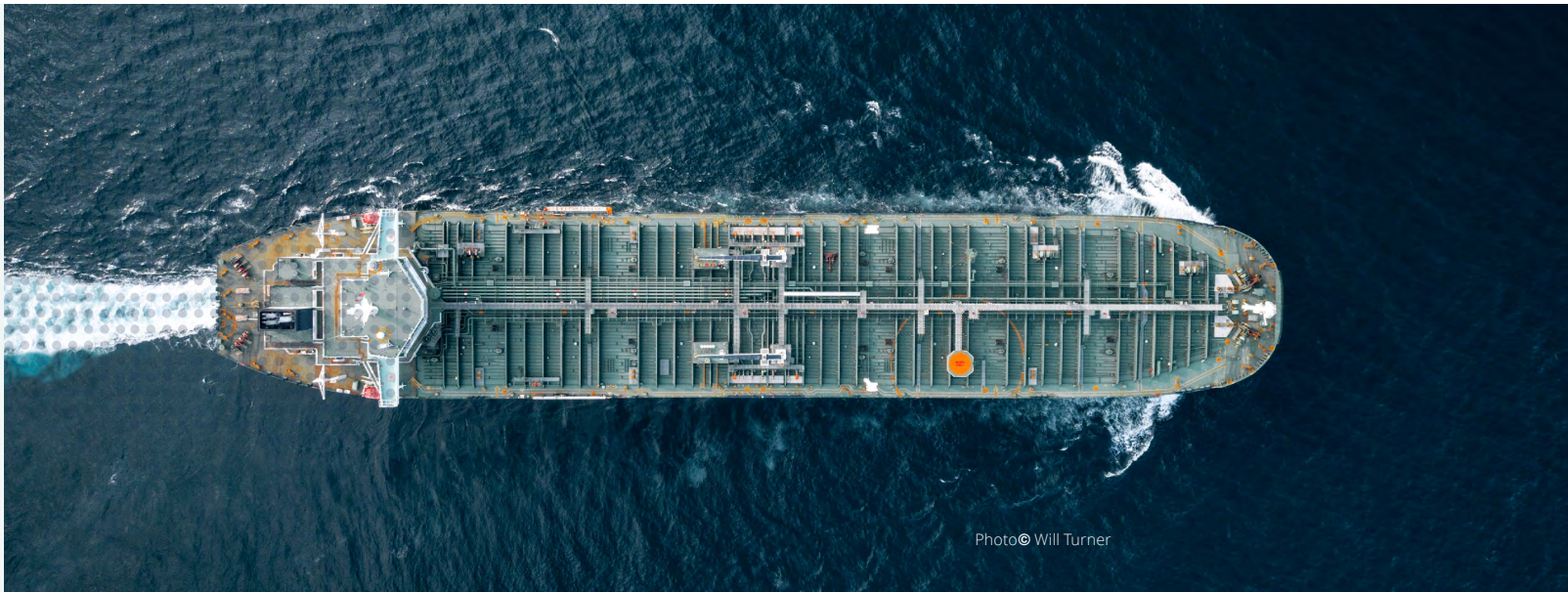
Circular Economy (CE) is a recognised concept for sustainable growth and is increasingly gaining ground globally. CE is expected to have a significant impact across products, markets, business models and value chains, but also on infrastructure, of which maritime in essence forms the backbone.

Yet, very little effort has been put into the exploration of the maritime opportunity space in the circular economy. Within the next ten years, we will see new business opportunities and concepts emerge, enabled by the transition towards a more circular society. A major part of this shift will be driven by digital technology, data, new platforms and, not least, new market players.

The objective of the Circular Shipping Initiative is to understand how shipping, as the backbone of global trade, can enable and capitalise on a circular conversion of global supply chains and to determine what type of collaboration across value chains these changes will require.

> Does a circular economy hold the potential to redefine shipping, from a commoditised service to a value-adding facilitator of a more circular flow of products, materials and services?

The digitalisation of the global supply chain allows new markets to be identified and commercialised. By leveraging their domain knowledge, shipowners may rethink their perceived role in the development of global circular supply chains, moving beyond commoditisation towards value-adding services and new partnerships.



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Our approach

A circular economy is increasingly being recognised as a guiding principle for business model innovation, but the potential role and opportunity space for shipping and logistics has so far hardly been analysed. Through a combination of primary and secondary data, desk-based research, industry expert interviews and a workshop, the partners behind this project have been exploring the role of shipping in a circular conversion of supply chains, the new partnerships required across the value chain, and how a circular economy can transform shipping from being commoditised into a service capturing value beyond the movement of cargo.

Exploring these elements from the perspective of the shipping industry has provided us with an understanding of the potential offered by a circular economy, particularly through the utilisation of digital technologies, enabling us to show how different opportunities may arise for the shipping industry and to identify new insights.

The circular supply chain introduces fully renewable, recyclable or biodegradable materials that can be used in consecutive life cycles to reduce costs and increase predictability and control.

Example: AkzoNobel's paints and coatings made from bio-based materials.

Product life extension recaptures value that would have been lost through disposal. By maintaining and improving products through repairs, upgrades, remanufacturing or remarketing, companies can keep them economically useful for as long as possible.

Example: Panasonic operates a high-tech disassembly, reuse and recycling plant, which recycles around 700,000 products a year currently.

Recovery and recycling revive materials previously designated as 'waste' for other uses. Companies either recover end-of-life products to recapture and reuse valuable material, energy and components or reclaim waste and by-products from a production process.

Example: Proctor & Gamble operates 45 facilities on a zero-waste basis, which has created more than $1 billion in value for the company over the past five years.

A sharing platform creates new business opportunities for consumers, companies and micro-entrepreneurs, who rent out, share, swap or lend their idle goods. Fewer resources go into making products that are infrequently used, and consumers have a new way to both make and save money.

Examples include Uber and Airbnb.

Product as a service, where manufacturers and retailers bear the total cost of ownership, adjusting their focus to the longevity and reliability of products and building new relationships with customers.

Example: Philips' 'pay-per-lux' solution which charges for lighting and Michelin's 'charge-per-kilometre' solution for tyres.

The future of logistics in a circular economy:

Doing good: good business or a licence to operate?

Doing well comes from doing good. Shared value can be created by turning social and environmental challenges into sustainable and fair business models that benefit all parties involved – a strategy where sustainable practices equal good business. A circular economy is a key example of this and is being adopted across industries globally.

Accordingly, we are seeing retail and consumer-facing organisations adjust their business models, from linear to circular processes and systems.

Many organisations have come forward to show support for the circular economy, with consumer brands such as the H&M Group partnering with the Ellen MacArthur Foundation and researching new approaches in the following areas:

- **Exploring solutions** to create a closed loop for textiles, where unwanted clothes can be recycled into new ones.
- **Setting sustainability targets** for a circular fashion industry within planetary boundaries using a science-based approach.
- **Applying circular economy principles** to its sustainability strategies, both for commercial and non-commercial goods, such as packaging.

While we often refer to B2C examples such as H&M above, B2B initiatives, partnerships and ecosystems are increasingly emerging. For both B2C and B2B-driven players, executing their strategies will require extensive changes throughout supply chains and the establishment of new ecosystem partnerships to truly succeed: a responsible, circular ecosystem requires responsible circular logistics.

Key enablers of circular logistics are digitisation and digital technologies. The increased availability of data and tools for efficient and meaningful analysis will provide the necessary information and transparency on the flow of goods and resources.

In logistics, structured collection and use of data is a key enabler of:

- **Optimising the route** and the management of assets
- **Getting stuff back:** Information on the location, availability and condition of assets/products

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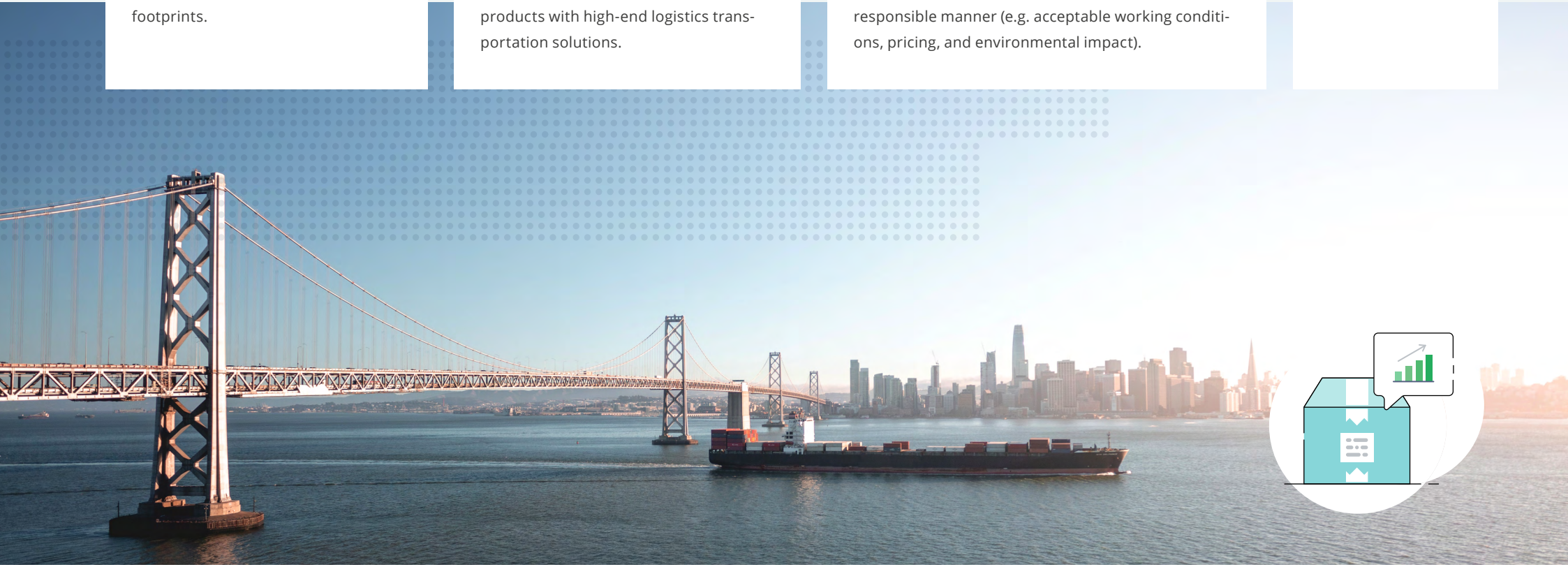
Circular logistics solutions include:

Circular economy logistics and sustainable packaging solutions. These include integrating recycling and logistics infrastructure; offering consultancy; and eco-efficient packaging solutions to reduce carbon footprints.

Fair access to basic necessities and logistics services has the potential to improve living conditions and economies in both developing and developed regions. This includes 'go local' initiatives that provide fair and regionally produced products with high-end logistics transportation solutions.

Responsible end-to-end logistics chains that incorporate fair production and trade practices. Logistics providers can drive transparency and traceability in global supply chains by providing services such as spot checking to identify responsibility risks and can certify processes to confirm they are conducted in a responsible manner (e.g. acceptable working conditions, pricing, and environmental impact).

Tracing materials back to the source will increase the traceability and transparency of products and materials.



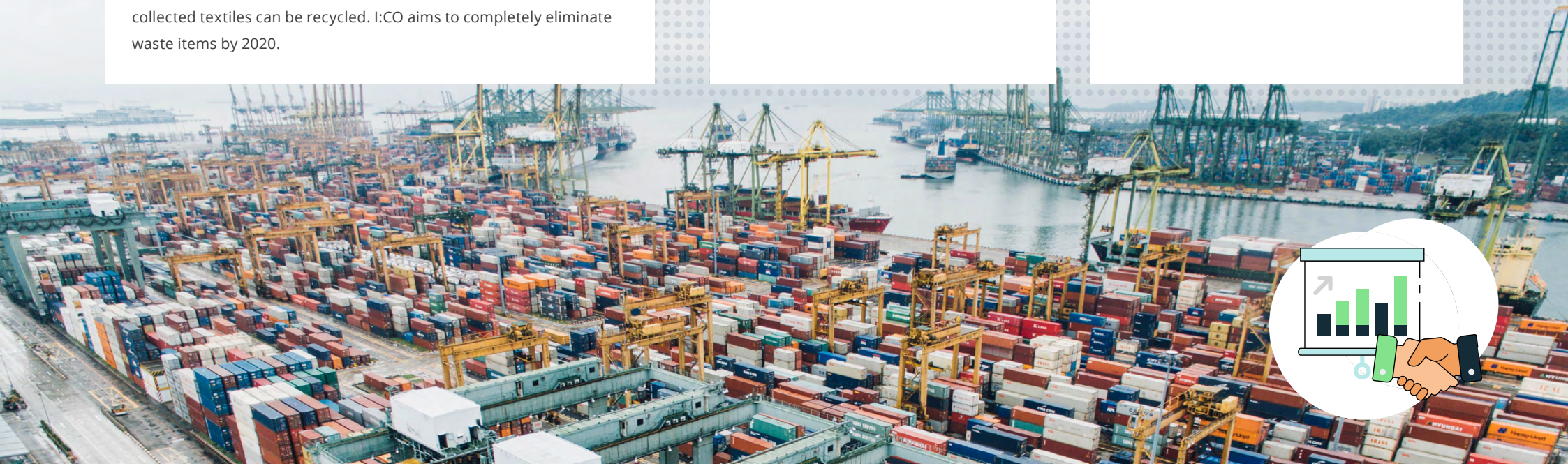
Circular ecosystems require circular logistics:

A circular ecosystem requires circular logistics. The reality is that the logistics aspect of a circular economy is often driven by non-logistics players:

I:CO has created an infrastructure that enables the recycling of valuable raw materials from textiles. It provides collection boxes and counters in its partner stores, among them shoe stores, fashion discount stores and supermarkets. I:CO arranges the environmentally friendly hand sorting of collected textiles, to determine whether they are suitable for rewear, reuse, removal or recycling. About 30% of the collected textiles can be recycled. I:CO aims to completely eliminate waste items by 2020.

Hewlett-Packard collects used HP cartridges from customers by offering free send-in solutions for private users and a free pick-up service for business users and public institutions.

Goodyear has focused on the sustainable production of its tyres by establishing a zero-waste programme for all its production facilities worldwide. Since establishing this programme in 2008, Goodyear has not sent any production waste to landfill.



Digitisation is the key enabler of a circular economy

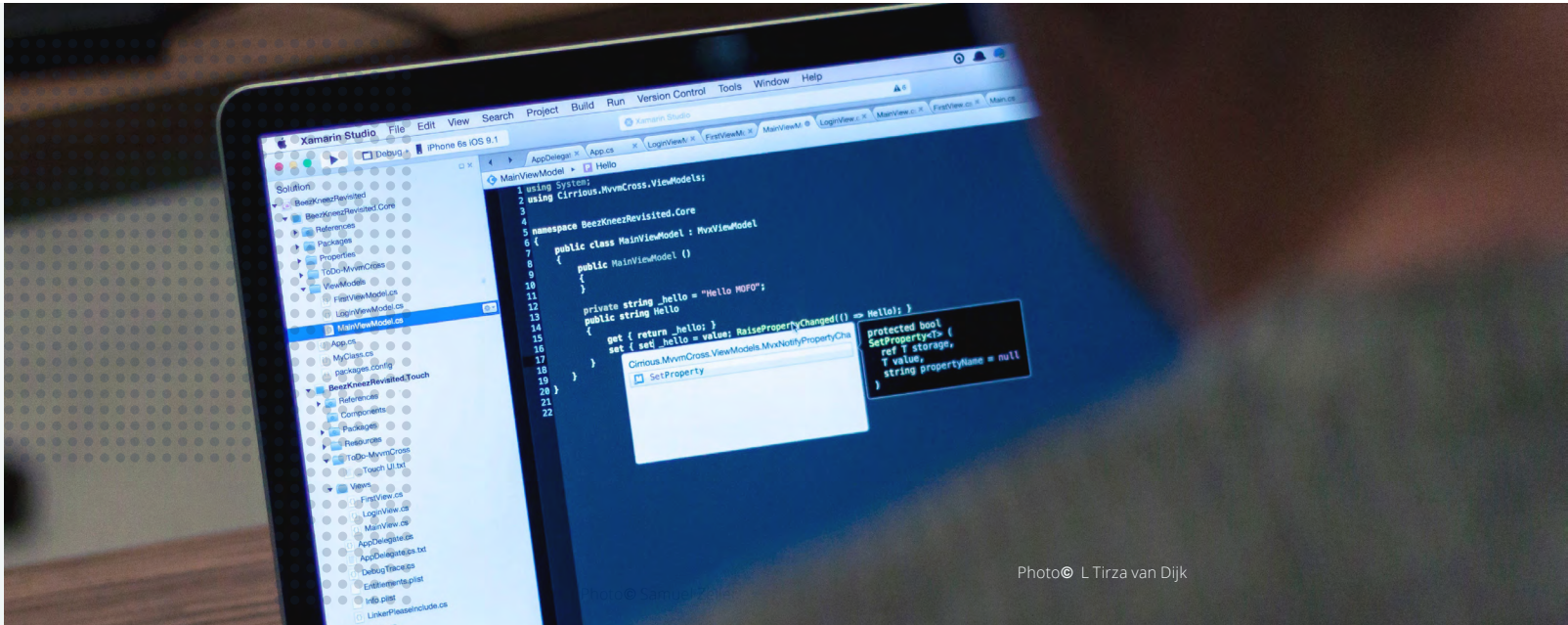
Focus on digitisation is not only a key transformation parameter, but also an enabler of a circular economy. In particular, it has an impact across industries and allows for new interfaces between sectors. These interfaces can be used to develop new business models and customer or partner relationships.

Understanding what things are made of, when they are made and by whom is a key parameter in a circular economy for successfully reusing and recycling them. To document this, two elements are essential: intelligent assets and the ability to track them. Obtaining sufficient, reliable and relevant data requires cross value chain collaboration, possibly encouraged by political or legislative measures.

There is a growing trend towards moving closer to the customer, allowing for easier customisation, upgrade and repair.

Many of the technologies mentioned here are already in use today in organisations such as H&M,. Machine learning is growing in use, with new methods and applications regularly being developed. Blockchain is gaining traction with increasing recognition of its uses and further developments improving its applicability to solutions.

A plethora of different technologies are available today, and while the circular economy remains material and resource focused currently, there is a correlation with future digitalisation. The outreach and uptake of such technologies will enhance the transition towards a circular economy, possibly securing the role of shipping in a future digital age.



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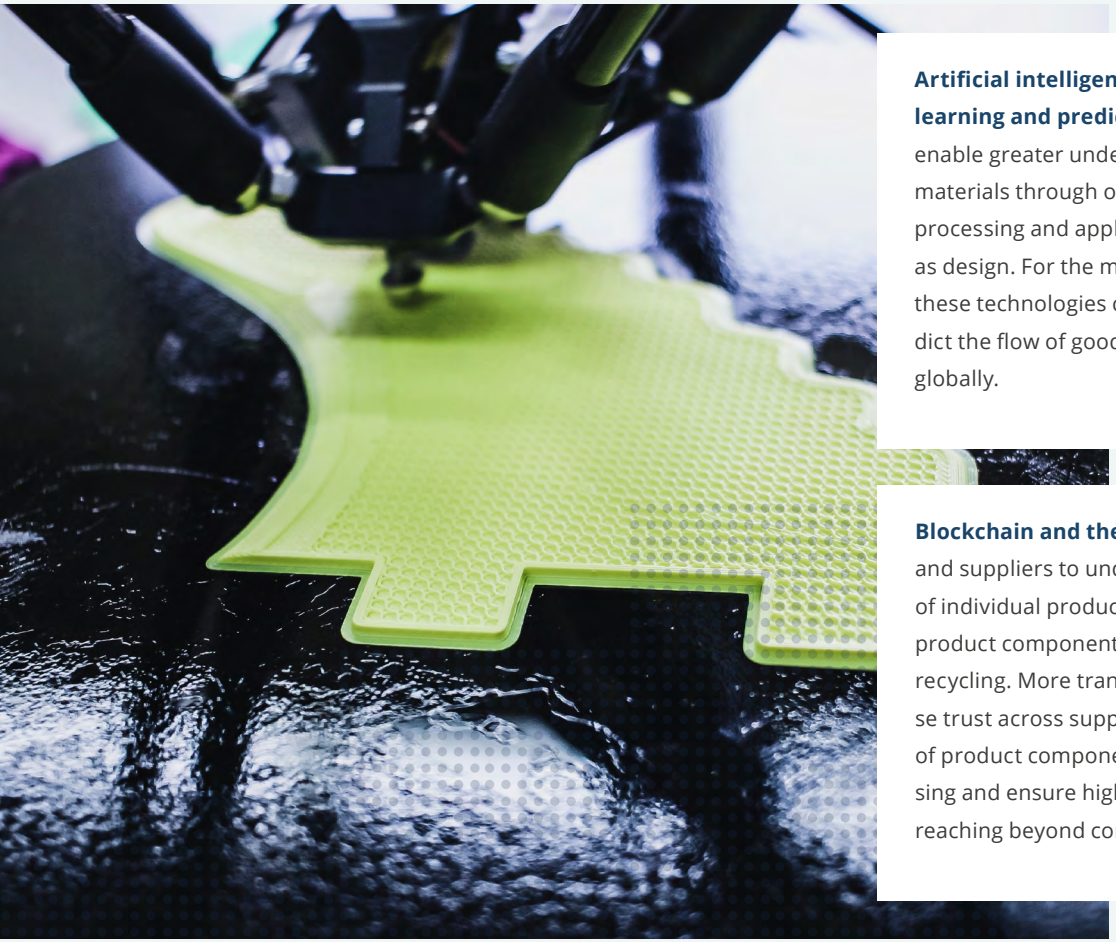
Enabling digital technologies includes

(but are not limited to):

Improving supply chain efficiency, increased data capture and greater access to digitised manufacturing processes are all benefits that can be achieved through the application of technologies as industries transition to circular systems.



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Artificial intelligence (AI), machine learning and predictive analytics enable greater understanding of materials through optimisation of processing and application, as well as design. For the maritime industry, these technologies can potentially predict the flow of goods and resources globally.

Additive (cloud) manufacturing and 3D printing represent high potential in their application in the transition from linear to circular processes. Optimising supply chains by creating hyper-local resource loops and regionalised manufacturing and repair improves efficiency times and allows for upgradability. This allows for specialist products to be customised and manufactured quickly, enabling shorter run times and offering new innovative services.

Blockchain and the Internet of things (IoT) allow manufacturers and suppliers to understand in greater detail the components of individual products. This allows organisations to demystify product components and build in better processes for reuse and recycling. More transparency and product information also increase trust across supply chains. Furthermore, greater understanding of product components creates opportunities to incorporate licensing and ensure higher environmental standards can be achieved, reaching beyond compliance.

The Circular Shipping Initiative:

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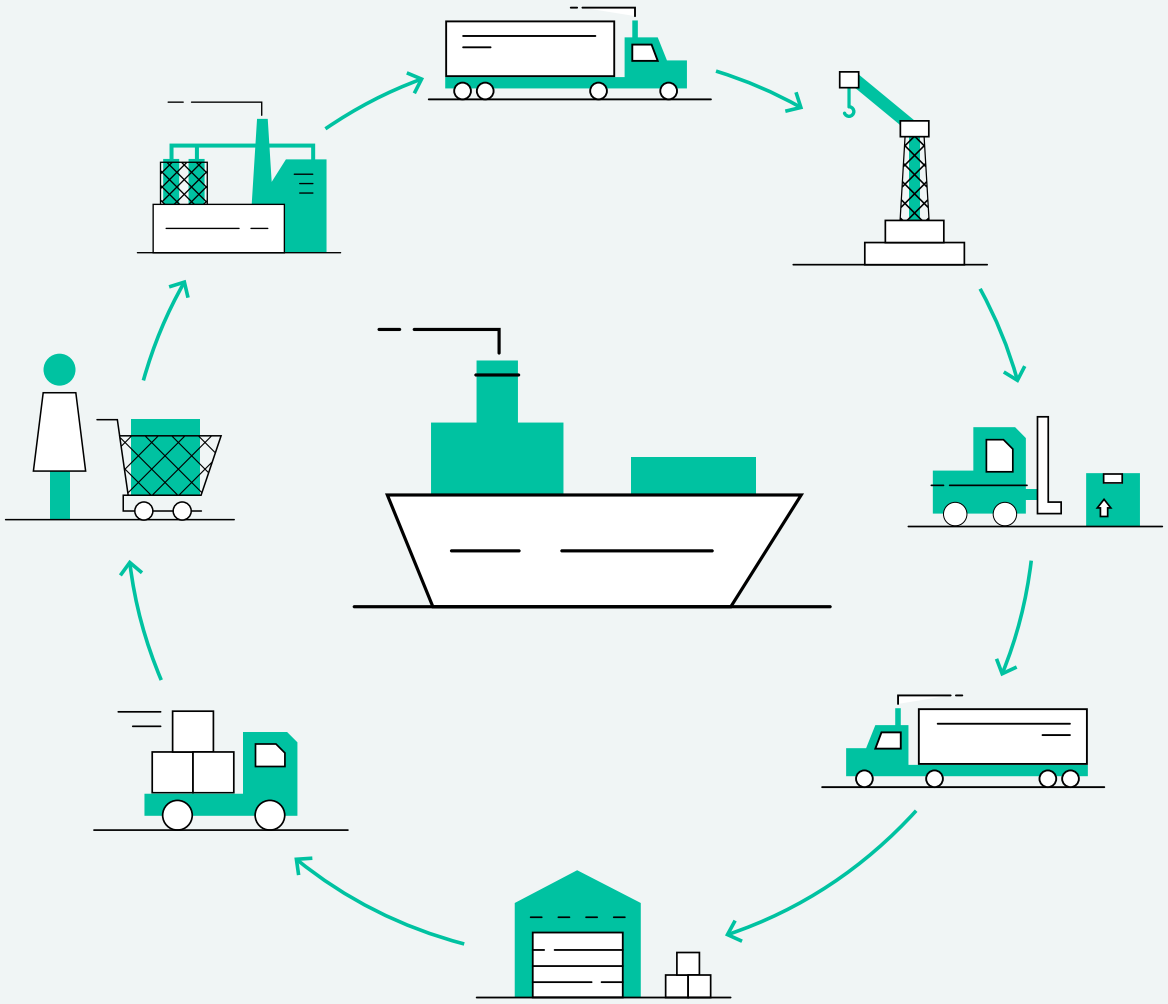

PART I:

Driving growth – navigating risks

The history of trade reflects the ongoing march of technological innovation. The next generation of technologies may reduce trade flows by changing the economics and location of production and transforming the actual content of what is traded across borders. The global agenda of tomorrow is being driven by flows of information and data, as well as technological changes that are reshaping industry value chains.

The shipping industry is centrally positioned but seems ill-prepared to take advantage of the emerging opportunities. The industry is primarily operated by small and medium-sized players, which in total operate more than 60,000 vessels sharing few standards. Most players are at an early stage of digital adaptation.

The core principles determining shipping demand is changing and players from outside the industry are working to carve out the more lucrative elements of the industry.

The highly fragmented structure of the industry makes it vulnerable to the digital transformation. This is likely not only to redefine how value is created but also to lead to large-scale consolidation. We may begin to see the creation of entirely new business models for vessel ownership created by players that do not currently own any vessels.

Companies have merged, and fleets have been acquired or combined in larger pools. But few of these activities have had much effect on profitability. The industry has been burdened by surplus capacity, low freight rates and depreciating secondhand prices for much of the past decade. This has reduced the strength of many balance sheets.

The introduction of climate-related regulation has brought new risks and new investment requirements, many of which mean that the adoption of new technologies is being focused on fuel saving. This shift is largely in line with many investors' call for distinct ESG profiles but is doing little to enable the industry to capture the opportunities from the integration of the various sectors throughout the global supply chain.

Many shipowners seem to be adhering to their traditional guiding principles and failing to consider the potential of digitalisation.

Lessons from other industries have taught us that digitalisation tends to fundamentally reshuffle how value is distributed among sectors and individual players, and in some cases even change how value is created.

These shifts call for business model innovation alongside the introduction of digital technologies into the core operation. Players that take advantage of these emerging opportunities may find it increasingly possible to deliver a return on invested capital.

"The industry has been burdened by surplus capacity, low freight rates and depreciating secondhand prices for much of the past decade.

PART II:

Reintroducing profitability into the shipping industry

The shipping industry has been following a cost savings narrative during the past decade. Still, few players have advanced the potential offered by standardisation and scale within vessel segments and across sectors. Cost savings are not enough; additional value needs to be identified and new services need to be launched. The introduction of circular business models represents an unprecedented opportunity for differentiation and value creation.

The global supply chain is still at an early stage of digitalisation. Individual sectors are being upgraded and connected, but existing assets are for many reasons not being upgraded to the highest standards possible. The transformative effects of the emerging changes are therefore hardly visible yet, but the introduction of hyperconnectivity and embedded intelligence at the edge will work to integrate and optimise all elements of the global supply chain within the next decade.

The operation of legacy infrastructures, upgraded or not, represents a challenge, since they may not be capable of fully harvesting the efficiency gains available to the latest generations (e.g. cost savings and additional streams of revenue). The economic lifetimes of legacy assets may be significantly shortened if they do not manage to integrate beyond their traditional markets.

In the shipping industry, shipowners need to move their value proposition beyond the boundaries of the volatile freight market. It is about creating additional streams of revenue by serving customers across a range of different sectors. This remains largely uncharted territory in the shipping industry, but more digitally mature industries have seen how the creation of new ecosystems is reshaping the competitive landscape by changing how value is created.

The democratisation of data has opened the gates to a range of unprecedented opportunities for players to create value without owning any vessels. The dominant asset-light business strategies relate to vessel positioning (i.e. transparency) and optimisation of the customer journey (i.e. supply chain optimisation). This is threatening some very basic elements in the traditional business model of vessel ownership in an industry where past value creation has often been a product of opacity and volatility.

In the future, the business model of vessel ownership is likely to become a utility that harvests benefits from digitisation, standardisation, economies of scale, transparency and circularity. Vessel ownership may become an ecosystem play that combines a variety of services and vendors on platforms that gradually expand into adjacent domains.

These ecosystem plays may even support the green transition of the industries underlying the global economy by enabling the introduction of circular economic principles.

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PART IIII:

A global transition towards a more circular economy

The circular economy presents existing businesses with opportunities and risks. The global transition towards a more circular global economy requires business model innovation that can promote a long-term investment horizon. Circular business models adopt new technologies and new materials that create additional value by taking a systemic view across the whole life cycle of assets.

A circular economy aims to redefine growth. It entails gradually decoupling economic activity from the consumption of finite resources (including fossil fuels) and designing waste and pollution out of the system. It works to keep products and materials in use, and to regenerate natural systems.

The vision for a circular economy represents a significant opportunity to fundamentally change how value is created in the global economy. The potential is massive, yet largely untapped, and applies to a range of different industries, including shipping.

For the shipping industry, the shift towards circularity could mean taking the opportunity to move beyond the commodity service currently being supplied to the market. Players that take an active role in facilitating the circular transition will connect more closely with customers by supporting their circular transition. Such a shift will support revenue generation not only through more stable access to repeatable cargo flows, but also through the creation of reverse logistics cargo flows and a home for a supply chain intelligence product.

Nevertheless, a gradual but global shift towards a circular economy is also likely to reduce seaborne trade volumes, change trading patterns and parcel sizes, ship designs, ship operation and ship recycling. Initially, these changes might seem more of a threat than a business opportunity for the shipping industry.

Traditional shipowners that do not work to seize the potential offered by digitisation but simply trade their vessels or rent them out are unlikely to turn the shift towards a more circular global economy into a business opportunity. However, the players that understand the emerging opportunity could benefit hugely.

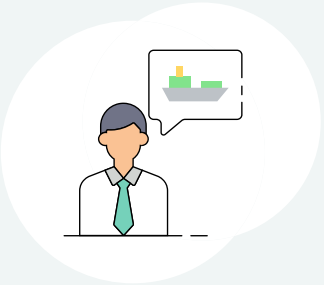
Players that innovate their business models in an attempt to achieve circularity prioritise long-term goals over short-term gains. Vessels will be designed, built and maintained for multiple lifetimes by the same owner.

Old vessels are considered material banks. Their records are collected in databases – as already seen in the automotive and aerospace sectors – that have been created to store the information required to facilitate reuse and to demonstrate residual value beyond the vessels' steel intensity at the end of their lifetimes.

The creation of intelligent materials and assets, and the ability to track, trace and document their performance, status and location are vital elements in a circular business model where value is created across multiple lifetimes.

PART IV:

A circular business model for vessel ownership



According to the next-generation business model for vessel ownership, the shipping industry will be a digital, circular and decarbonised utility supplying vessel capacity to the market as a service. Vessels will be standardised and built for multiple lifetimes, and spare parts will be designed to be recycled, reused and remanufactured. Vessels will increasingly be employed in circular relationships where revenue is as likely to be created from the movement of recycled and virgin materials as from data intelligence.

The current business models for vessel ownership are increasingly struggling to deliver risk-adjusted returns on invested capital.

The next-generation business model for vessel ownership may be significantly different from the current one. It will be designed to reap the benefits of standardisation and economies of scale. It will be digital, decarbonised and circular. Vessels across ship segments will be designed to share as many standards as possible.

Vessels will be designed, built and maintained for multiple lifetimes, meaning that all components and spare parts that need replacing will be recycled and reused for new components.

This will not only save energy and consumption of virgin materials, but it will also allow a more flexible approach to vessels' economic lifetimes, since the cost of building the next-generation vessels will be significantly reduced.

The next-generation business model for vessel ownership will entail supplying capacity to the market as a service. For operators, the new business model for vessel ownership can be considered just another alternative to existing tonnage providers.

Digital ships will increasingly become integrated elements of the global supply chain. Vessels will be considered a critical element of the infrastructure that enables the movement of cargo (i.e. virgin or recycled) from origin to destination in repeated loops of learning and optimisation.

Owners of these new super structures will orchestrate new ecosystem plays that work to optimise not only the movement of cargo, but also the operation of vessels. The performance data collected from operating the vessels will be sold to equipment manufacturers to help them improve their offerings.

“Digital ships will increasingly become integrated elements of the global supply chain.

PART V:

The circular potential

The digital transformation of the global supply chain does not necessarily mean a sea change for every company in every part of the industry at the same time, although all ship segments are expected to be affected by digitisation at some point. These trends are as likely to impact the container and the ro-ro players as the players operating tanker or dry bulk vessels. But the implications and the impact of these changes will vary greatly between ship segments.

Cargo movements may decline despite increasing demand, since new technologies that enhance supply chain visibility allow players to respond to imbalances quickly by reshaping demand or redirecting supply.

The circular transformation of the global economy, cargo flows and seaborne demand is enabled by digitisation. Current trade volumes, trading routes and parcel sizes would change dramatically in segments where cargo flows become optimised towards circularity (i.e. multiple lifetime).

Some ship segments could even see lower trade volumes and shorter travel distances. Still, not all cargo types are obvious candidates for multiple lifetimes. Danish Ship Finance estimates that this is only the case for six out of ten cargo movements. Fossil fuels and grains, for example, hold little potential for reuse, as these commodities are consumed.

In 2015, Danish Ship Finance presented a 2030 demand outlook, predicting that distance-adjusted seaborne trade volumes should increase by the equivalent of an annual average of 1% up to 2030.

This forecast is beginning to look like a best case rather than a base case in the perspectives of the global economy's gradual adaptation of circularity and the transition towards renewable energy.

It goes without saying that these changes can introduce massive challenges to current business models if we fail to reinvent some key elements of the current operation. But by working to create more circular business models, players may not only work to reduce costs and create new streams of revenue but also establish strategic relations with their customers that may differentiate them from their competitors.

> "Fossil fuels and grains hold little potential for reuse, as these commodities are consumed.

PART VI:

New types of business models in the shipping industry

With digitisation come opportunities to leapfrog other players. Digital technology lowers costs and enhances efficiency, but it becomes increasingly hard for individual players to develop a competitive edge if operational excellence is delivered through third-party algorithms or software available to all industry players. In many cases, these new technologies are simply redefining shipowners' licence to operate.

The strategies powering the industry of tomorrow are likely to be grouped within three categories. A group of existing players will continue to operate according to their traditional guiding principles while neglecting the potential presented by digitisation. Another group of players will direct their efforts towards 'asset-light' business models, operating other people's fleets. This group of players are likely to monetise the data rather than the cargo. They will aim to orchestrate an ecosystem play by easing consumers' pain points across the global supply chain (i.e. value beyond the vessel). The last group of players will develop strategies that build ecosystem plays around the ownership of vessels and work to harness the benefits of standardisation and scale (reinventing the operating model).

We have presented a framework for a circular business case that aims to reinvent the operating model for vessels ownership. In this structure, digitisation of the shipping industry and the industry's increased focus on sustainability are powering the business model innovation that will restore profitability to vessel ownership.

This play is not available for everyone; it will need a strong capital base and the creation of partnerships that can facilitate the necessary shifts. But if it gains pace and begins to define larger parts of the industry, it will introduce massive changes to the way value is created in the industry.

"We have presented a framework for a circular business case that aims to reinvent the operating model for vessel ownership.

Conclusion

The digital transformation of the shipping industry, the global shift towards more sustainable practices, and the maritime industry's deeper integration into global supply chains will test core business models and fundamentally change shipowners' licence to operate. Some players will focus on the ecosystem play related to the movement of cargo, others will work to standardise and scale the business model for vessel ownership, while the more traditional players will continue to operate as they have always done.

Shipowners that do adapt to the emerging changes and begin to digitalise and innovate their business models may begin to deliver higher returns on invested capital.

A circular economy is a key enabler for change, but its successful deployment will require strategic partnerships across industries. The maritime industry and shipping in particular have a key role to play in future ecosystems, and accordingly, a circular economy holds the potential to redefine shipping, from a commoditised service to a value-adding facilitator of a more circular flow of products, materials and services.

The digitisation of global supply chains will allow new markets to be identified and commercialised. By leveraging their domain knowledge, shipowners may rethink their perceived role in the development of a global circular supply chain, moving beyond commoditisation towards value-adding services and new partnerships.

This will require a fundamental mindset change. Shipowners must claim their role and co-develop future circular ecosystems with customers and supply chain partners, as well as digital players. For traditional shipowners, there is a real risk that they will become obsolete if the circular ecosystems are designed without any input from logistics and shipping.

> "Shipowners must claim their role and co-develop future circular ecosystems with customers and supply chain partners, as well as digital players...

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About this publication

This publication is intended to inspire and encourage further exploration of the circular economy and the opportunities it may present.

It is the initial result of the Circular Shipping Initiative project, a collaboration between Danish Ship Finance, Green Ship of the Future, Leaderlab and The Shared Value Company with advising partners Danish Shipping and DFDS.

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